

# Breakthroughs in stem cell research

## Study aims to alter cells to embryonic ones that can morph and help rebuild ailing organs

BIOLOGIST Ng Huck Hui dreams of turning back the clock.

His research involves transforming regular cells back into embryonic stem (ES) cells – the body’s blank-slate cells that can morph into anything the body needs, from brain, to heart, to nerve. If he succeeds, the knowledge gained will open the door to the kind of individualised medicine where patients bank their own cells, which can then be coaxed into the rebuilding of ailing or diseased organs.

His latest coup has been to discover the most important genes in human ES cells, singling out those critical to keeping such cells in their original state.

The human body is made up of more than 200 cell types, the building blocks of tissues and organs. Stem cells divide and can mature into specialised cell types called adult stem cells. Blood stem cells, for example, can become all sorts of blood cells: red, white or platelets. But ES cells do not occur in adults and are obtained from early-stage embryos.

Researchers in Singapore were the first in the world to look through the entire human genome on such a massive scale, sifting through the entire complement of 21,000 genes to discover more than 500 candidates that keep ES cells in their unchanged state. “Doing this in one experiment rather than one gene at a time makes it much more complicated,” said Dr Ng. “It’s like having air-traffic control looking at thousands of planes at once.”

Among the key genes discovered by Dr Ng and his team this year was PRDM14, which makes it faster and easier to “reprogramme” skin cells back into stem cells.

In a separate development, in 2006, a group led by Dr Shinya Yamanaka in Japan was able to reprogramme skin cells to become “pluripotent” stem cells, which

are very much like ES cells.

The hope is that pluripotent stem cells can be used to create specialised cells to transplant into the brains of Parkinson’s patients, or into heart disease patients to enhance heart function, for example.

PRDM14 allows stem cell colonies to grow three to four times faster than usual, said Dr Ng, senior group leader for stem cell and developmental biology and associate director for biology at the Genome Institute of Singapore.

His team worked with a group led by Institute Of Molecular and Cell Biology principal investigator Frederic Bard, and their work was published in the top scientific journal Nature in October.

Dr Janet Rossant, senior scientist at the developmental and stem cell biology programme at Canada’s Hospital for Sick Children, said the “unprecedented scale” of the effort had added considerable new information to understanding such cells’ amazing capacity to turn into any cell, and would help in efforts to reprogramme adult cells back into stem cells.

Said Dr Ng: “Many other labs were trying to do this, but our breakthrough highlights the kind of critical mass we have for such work. We have the right mix of people willing to come together and work on important projects.”

The work of Dr Ng and others like him has given Singapore a reputation in human ES cell research that is up there with the heavyweights. In 2008, the leading industry journal Cell Stem Cell ranked Singapore fourth, behind Britain, Israel and China, in the field, after looking at papers published on breakthroughs.

Dr Alan Colman, executive director of the Singapore Stem Cell Consortium, lauds Dr Ng and his colleagues for “keeping Singapore at the top table of countries plundering the secrets of human embryonic stem cell regulation”.

Dr Ng’s work has been cited more than 8,000 times by other scientists in their research papers. His work is far from done though, the adjunct associate professor at NUS and NTU said, and he sees many more years of investigation ahead. But the end goal is worth the effort.

“It’s really important to understand how we can shuffle between the two states of being a stem cell versus a normal cell,” he said. “Once we know enough, we can control them.”

CHANG AI-LIEN



Embryonic stem cells are the body’s blank-slate cells which can turn into any cell that the body needs. If Dr Ng succeeds in his research, the knowledge gained will open the door to the kind of individualised medicine where patients can bank their own cells, which can then be coaxed into the rebuilding of ailing or diseased organs.

ST PHOTO: AZIZ HUSSIN